

***Remarks***

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-17 are pending in the application, with claims 1, 9 and 14-16 being the independent claims. New claim 17 is sought to be added. Support for new claim 17 can be found, *inter alia*, at page 8, lines 11-14 of the specification. Claims 1 and 7 have been amended. Claim 1 is amended to clarify what Applicants claim as their invention. Support for the amendment to claim 1 can be found, *inter alia*, on page 6, line 19-22. Support for the amendment to claim 7 can be found, *inter alia*, on page 10, line 20, through page 11, line 2. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

***I. Drawings***

Applicants note with appreciation that the Examiner has approved the drawings.  
(Office Action, page 2, line 3).

***II. Objection to the Oath/Declaration***

The Examiner has objected to the Oath/Declaration "because: the oath, declaration or application data sheet does not acknowledge the filing of provisional application no. 60/109, 427. A new oath, declaration or application data sheet is required in the body of which the present application should be identified by application number and filing date." (Office Action, page 2, lines 15-18).

In compliance with 37 C.F.R. § 1.76, Applicants submit herewith an Application Data Sheet (ADS). On the submitted ADS, the present application claims the benefit of U.S. Provisional Appl. No. 60/109,427. Applicants respectfully submit that the objection has been rendered moot and request that it be withdrawn.

***III. Objection to the Specification***

The Examiner is of the opinion that "[t]his application does not contain an abstract of the disclosure as required by 37 CFR 1.72(b)." (Office Action, page 2, lines 20-21). Applicants respectfully disagree.

Applicants submit herewith a one page abstract, on a separate sheet, in compliance with 37 C.F.R. § 1.72(b). Applicants respectfully submit that the objection has been rendered moot and request that it be withdrawn.

***IV. Rejections under 35 U.S.C. § 112, 2nd paragraph (claim 7)***

Claim 7 has been rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. (Office Action, page 3, lines 4-6). Applicants respectfully traverse this rejection.

The Examiner is of the opinion that: "[c]laim 7 is indefinite because a soil that is 'acidified' is open to individual interpretations, depending upon the initial pH." (Office Action, page 3, lines 7-8). Applicants respectfully disagree.

Amended claim 7 recites "[t]he method of claim 1, wherein an acid is added to the soil prior to cultivation." The specification gives guidance to one of ordinary skill in the art on what acid to use, how much acid to use and when to use the acid (see, *e.g.*, page 10, line 20, through page 11, line 2). Claim 7 is not indefinite, therefore, because one of ordinary skill in the art would understand the plain meaning of claim 7 when read in light of the specification. Applicants respectfully submit that the rejection of claim 7 has been overcome and request that it be withdrawn.

***V. Rejections under 35 U.S.C. § 112, 1st paragraph***

***A. First rejection (claims 6, 10, 14 and 15)***

Claims 6, 10, 14 and 15 have been rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as

to enable one of ordinary skill in the art to make and/or use the invention. (Office Action, page 3, lines 15-18). Applicants respectfully traverse this rejection.

The Examiner is of the opinion that "[s]ince the seed claimed is essential to the claimed invention, it must be obtainable by a reproducible method set forth in the specification or otherwise be readily available to the public." Applicants respectfully disagree.

However, in order to expedite the allowance and issue of the present application, the undersigned Attorney for Applicants hereby states that the deposited seed of *Thlaspi caerulescens* G15 will be irrevocably and without restriction or condition released to the public upon the issuance of a patent. Applicants respectfully submit the rejection to claims 6, 10, 14 and 15 has been rendered moot and request that it be withdrawn.

**B. Second rejection (claims 1-5, 7-9, 11-13 and 16)**

Claims 1-5, 7-9, 11-13 and 16 have been rejected under 35 U.S.C. § 112, first paragraph, as "[t]he specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention commensurate in scope with these claims." (Office Action, page 4, lines 12-14). Applicants respectfully traverse this rejection.

The Examiner is of the opinion that:

Applicant has not provided guidance other than *T. caerulescens* G15 having the metal-accumulating property as recited in the claims, or a method for using other than *T. caerulescens* G15 plants to effectively recover 0.1% to 0.6% of Cd and/or 1.5% to 3% Zn. No guidance has been provided for how to select genotypes that may be suitable in Applicant's method so that

the desired amount of Zn and Cd can be recovered, without injury to the plant.

The state of the art as evidenced by Salt *et al* (Biotechnology, vol. 13, pp. 468-474, 1995, Applicant's IDS) teaches that the ability of a plant to accumulate heavy metals is a genotype dependent and varies greatly between species and between cultivars within the species (page 469, column 2, Phytoextraction). Therefore, absent any specific guidance on how to identify or select a suitable genotype, one skilled in the art would not be able to use any *T. caerulescens* to extract the desired amount of Cd and/or Zn, without undue experimentation.

(Office Action, page 5, line 17, through page 6, line 7). Applicants respectfully disagree.

"Enablement is not precluded by the necessity for some experimentation such as routine screening." *In re Wands*, 858 F.2d 731, 736-37 (Fed. Cir. 1988) (citation omitted).

"The determination of what constitutes undue experimentation in a given case requires the application of a standard of reasonableness, having due regard for the nature of the invention and the state of the art." *Id.* at 737 (quoting *Ansul Co. v. Uniroyal, Inc.*, 448 F.2d 872, 878-79 (2d Cir. 1971), *cert. denied*, 404 U.S. 1018 (1972)).

Applicants submit the specification gives specific guidance on how to identify and select suitable genotypes using routine screening (see, *e.g.*, page 9, lines 1-23 of the specification). The specification defines a standard for what constitutes suitable metal accumulation (see, *e.g.*, page 7, lines 3-7 and claim 1 of the specification). The methods used in the screening process, i.e. those for collecting genotypes of *T. caerulescens*, finding areas of contaminated soil for screening, cultivating the plants and measuring levels of accumulated metals, are all well known to one of ordinary skill in the art. The specification also teaches how to increase metal accumulation in all genotypes by manipulating soil conditions through changes in pH and addition of fertilizers, metal chelators and chloride salts (see, *e.g.*, page 10, line 1, through page 12, line 28 of the specification). Following

these teachings, one of ordinary skill in the art could collect other genotypes of *T. caerulescens*, cultivate the species in contaminated soil under favorable conditions, measure the amount of accumulated metal and identify additional suitable genotypes. The specification gives sufficient guidance on how to identify and select suitable genotypes other than *T. caerulescens* G15 without requiring unreasonable experimentation. Applicants respectfully submit that the rejection of claims 1-5, 7-9, 11-13 and 16 has been overcome and request that it be withdrawn.

Moreover, "[t]he presence of only one working example should never be the sole reason for rejecting claims as being broader than the enabling disclosure . . ." M.P.E.P. § 2164.02. Applicants submit the screening method disclosed resulted in a single positive example. In other words, the screening method found one species out of thirteen that accumulated suitable levels of Zinc and Cadmium from contaminated soil to enable the claimed invention (see, *e.g.*, Figure 1 of the specification). The variability in metal uptake among genotypes does not show the screening method is unpredictable or irreproducible, it shows that some genotypes of *T. caerulescens* are better at accumulating Zinc and Cadmium than others and that the screening method works as designed. The factors that effect metal accumulation in *T. caerulescens* are predictable. The specification gives specific guidance on how to adjust levels of soil acidity, fertilizers, metal chelators, phosphorous and chloride content to increase metal accumulation in *T. caerulescens*. The single positive example demonstrates, therefore, how one of ordinary skill in the art could perform, under favorable conditions, a reasonable amount of screening to identify additional suitable genotypes of *T. caerulescens*. Applicants submit the rejection to claims 1-5, 7-9, 11-13 and 16 has been overcome and request that it be withdrawn.

**VI. Rejections under 35 U.S.C. § 102**

**A. First rejection (claims 1-4, 7-9, 11-13 and 16)**

Claims 1-4, 7-9, 11-13 and 16 have been rejected under 35 U.S.C. 102(b) as being anticipated by Brown *et al.* (*Soil Sci. Soc. Am. J.*, 59:125-133 (1995)). (Office Action, page 7, lines 1-2). Applicants respectfully traverse this rejection.

The Examiner is of the opinion that:

Brown et al teach a method of using *Thlaspi caerulescens* in the phytorecovery of Cd and Zn from cadmium and zinc-contaminated media. *T. caerulescens* plants, together with non-metal accumulating plant species, were grown on nutrient solutions treated with various concentrations of Cd and Zn, to determine Zn and Cd accumulation and tolerance in each plant (page 126, Materials and Methods and Table 1). In one of the treatments, *caerulescens* plant s accumulated more than 25000 mg Zn/kg and 1000 mg Cd/Kg without effecting the plant growth and yield (see at least Results and Discussion on page 127). The reference teaches that specific genotypes of *T. caerulescens* may be strong candidates for the phytoremediation of Zn and Cd contaminated soils (Abstract). Since Brown et al teach a mature *T. caerulescens* plant, pollen and propagation material are inherently parts of the plant.

(Office Action, page 7, lines 10-20). Applicants respectfully disagree.

**Claims 1-4, 7 and 8**

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). Brown teaches phytoextraction of metals from solution (see, *e.g.*, Brown, page 126, col. 1, lns. 28-

32). In contrast to Brown, claim 1 of the present invention is drawn to a method of recovering cadmium and/or zinc from soil. Because Brown does not teach the phytoextraction of cadmium and/or zinc from soil, Brown does not anticipate claim 1. And since claims 2-4, 7 and 8 are dependent on claim 1, Brown does not anticipate claims 2-4, 7 and 8. Applicants respectfully submit the rejection of claims 1-4, 7 and 8 has been overcome and request that it be withdrawn.

***Claims 9 and 11-13***

Brown teaches a *Thlaspi caerulescens* plant grown from nutrient solution (see, *e.g.*, Brown, page 127, col. 1, lns. 13-14). In contrast to Brown, claim 9 of the present invention is drawn to a *Thlaspi caerulescens* plant cultivated on cadmium- and/or zinc-containing soil. Because Brown does not teach a plant cultivated from soil, Brown does not anticipate claim 9. And since claims 11-13 are dependent on claim 9, Brown does not anticipate claims 11-13. Applicants respectfully submit the rejection of claims 9 and 11-13 has been overcome and request that it be withdrawn.

***Claim 16***

Brown teaches a method for phytoextracting metals from solution using *Thlaspi caerulescens* (see, *e.g.*, Brown, page 126, col. 1, lns. 28-32). In contrast to Brown, claim 16 of the present invention is drawn to a method of decontaminating soil containing cadmium and/or zinc, comprising cultivating at least one *Thlaspi caerulescens* plant. Because Brown



does not teach a method of decontaminating soil, Brown does not anticipate claim 16. Applicants respectfully submit that the rejection to claim 16 has been overcome and request that it be withdrawn.

**B. Second Rejection**

Claim 5 has been rejected under 35 U.S.C. 102(b) as being anticipated by Soriano *et al.* (U.S. Patent No. 4,326,884). (Office Action, page 8, lines 1-2). Applicants respectfully traverse this rejection.

The Examiner is of the opinion that: "Soriano *et al* teach zinc and cadmium containing ores. The claimed product is indistinguishable from those of the prior art; therefore, Soriano *et al* anticipate the claimed invention." (Office Action, page 8, lines 5-7). Applicants respectfully disagree.

Applicants submit Soriano teaches two ores, a calcined floatation zinc concentrate (see, *e.g.*, Soriano, col. 5, lns. 64-68) and a lead concentrate (see, *e.g.*, Soriano, col. 6, lns. 22-23). Claim 5 of the present invention is drawn to a zinc and/or cadmium-containing ore produced by incinerating biomass material. As taught in the specification, "the plant tissue is collected, incinerated and reduced to ash with energy recovery. . . . The result is plant ash of a high grade ore." (page 8, lines 11-14 of the specification). In contrast to Soriano, the ores of the present invention are produced by incinerating *T. caerulea* plants. The material, other than zinc and/or cadmium, in the ores of Soriano is different than the material, other than zinc and/or cadmium, in the ores of the present invention. Because the ores in Soriano are different than the ores in the present invention, Soriano does not

anticipate claim 5. Applicants respectfully submit the rejection to claim 5 has been overcome and request that it be withdrawn.

### ***Conclusion***

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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Date: June 23, 2003

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## ***Thlaspi caerulescens* Subspecies for Cadmium and Zinc Recovery**

### ***Abstract***

A cadmium- and zinc-hyperaccumulating subspecies from *Thlaspi caerulescens* and methods for removing and optionally recovering cadmium and zinc from soil using phytoextracting techniques wherein the subspecies is cultivated on soil containing cadmium and zinc.

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